

New species of *Eurytoma* associated with Cynipidae¹

(Hymenoptera: Eurytomidae)

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The genus *Eurytoma* Illiger was last revised in 1967 by Dr. R. E. Bugbee. Since that time a number of additional species have been described prompting him to update his revision. I am publishing the following names to make them available for inclusion in his forthcoming work as well as for use in my own study of *Eurytoma* associated with Cynipidae. In addition, the types of *E. californica* Ashmead and *E. querci* Fullaway have been compared and are considered conspecific. The latter name has been placed in synonymy with *E. californica*.

***Eurytoma adiacrita* Grissell, new species**

HOLOTYPE FEMALE.—Length 4.2 mm. Mostly black with yellow as follows: fore and midfemora mostly, hindfemur apically, foretibia below entirely and along margins above, mid and hindtibiae apically, hindtarsus distally. Mandibles and wing veins reddish brown. Pubescence silvery white. Flagellum filiform with F1–4 longer than wide, F5 about as wide as long, pedicel 0.78 times length of F1. Face not striate, malar space with setigerous pits, post genal lamella present. Depression on anterior face of forecoxa distinct, moderately deep. Propodeum with wide median furrow, narrowing ventrally, lateral carinae complete to base, central carina distinct in upper $\frac{3}{4}$ of furrow, lateral surfaces wide with irregular ridges, spaces between ridges with small, uneven punctures. Postmarginal vein straight, 1.0 times length of marginal vein (Fig. 7). Abdomen oval in lateral view and somewhat compressed (Fig. 5), petiole directed downwards and with a distinct projection dorsally, ovipositor tilted about 35° from horizontal axis of abdomen, lateral surfaces of tergum VI with dense reticulation covering lower $\frac{1}{3}$ completely, thinning to anterior margin medially, very sparse reticulation extending dorsally as a thin band along anterior margin, terga IV and V laterally with heavy reticulation covering anterior half of surface, thinning dorsally as on VI, dorsal surfaces of segments IV–VI appearing highly polished with reticulations showing only under certain reflections, tergum VI in dorsal view 1.8 times as long as V and in lateral view $\frac{1}{3}$ length of abdomen, tergum IX 0.28 mm. Genitalia as in Figure 2.

ALLOTYPE MALE.—Length 2.3 mm. Color as in female except mid and hindfemora and tibiae mostly black. Antenna with five pedicellate flagellomeres which are longer than wide and a terminal unit of two closely fused articles, scape swollen anteromedially (Fig. 13). Face and coxae as in female. Propodeum about as in female except central carina distinct in upper half of furrow. Post-

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marginal vein 1.0 times length of marginal vein. Abdominal petiole cylindrical, 3.1 times as long as widest point, 1.3 times length of hindcoxa.

HOLOTYPE FEMALE, FOLSOM LAKE, PLACER COUNTY, CALIFORNIA, emerged May 1967 from *Besbicus conspicuus* (Kinsey) on *Quercus lobata* Nee, D. C. Dailey collector; allotype male, 12 ♀, and 8 ♂ paratypes same data as holotype except em. 2–11 May 1967. Paratypes, 14 ♀, 12 ♂ all from California: Contra Costa Co.: 4 ♀, 5 ♂, Mt. Diablo State Park, 4 November 1958 (R. L. Doutt) ex *Antron echinus* (Ashmead) on *Q. douglasii* Hooker and Arnott. Placer Co.: 8 ♀, 3 ♂, Rocklin, em. 12 May to 14 June 1967 (D. C. Dailey) ex *Antron echinus* on *Q. douglasii*. Yolo Co.: 2 ♀, 4 ♂, 3 miles sw. Madison, em. 29 October to 15 November 1968 (E. E. Grissell) from *Andricus kingi* Bassett on *Q. lobata*.

Holotype, allotype, and paratypes of *E. adiacrita* are deposited in the Entomology Museum, University of California at Davis. Paratypes have also been placed in the Division of Biological Control (University of California, Albany), in the U.S. National Museum, and in the Bugbee Collection (Meadville, Pa.).

Variation.—Females of *E. adiacrita* range in length from 2.7 to 5.3 mm ($\bar{x} = 3.8$; $N = 36$) and males from 1.6 to 3.1 mm ($\bar{x} = 2.3$; $N = 29$). In females the pedicel averages 0.67 times F1 (range 0.47–0.90), the postmarginal vein averages 0.98 times the marginal vein (0.86–1.2), tergum VI averages 1.9 times V (1.5–2.3), and tergum IX averages 0.20 mm (0.11–0.30). In males the postmarginal vein averages 0.98 times the marginal (0.86–1.2); the abdominal petiole averages 3.0 times as long as wide (2.4–3.8) and 1.3 times the length of the hindcoxa (1.1–1.4).

E. adiacrita is predominantly black. The legs, however, may show some variation in the amount of yellow coloration. Some large specimens of both sexes have two shallow, submedian depressions just above the clypeus. In smaller specimens, these depressions are not distinct. Males, in many instances, have the scape distinctly enlarged antero-medially (Fig. 13), but this is not always as pronounced as illustrated. In both sexes the median furrow of the propodeum is complete, but in some specimens the lateral carinae become irregular ventrally. While the central carina is so indistinct ventrally as to appear incomplete, it is generally present at least in the upper half of the furrow of both sexes.

Hosts.—*Eurytoma adiacrita* has been reared from galls of the cynipids *Antron douglasii* (Ashmead), *Andricus kingi* Bassett, and *Besbicus conspicuus* on *Quercus lobata*, and *Antron echinus* on *Q. douglasii*. *Antron douglasii* and *A. echinus* also serve as hosts for *Eurytoma foligalla* Bugbee, and both species of *Eurytoma* may occasionally be reared from the same species of cynipid (though not necessarily the same gall) occurring in the same locality.

Systematics.—*E. adiacrita* may run to one or other of two species

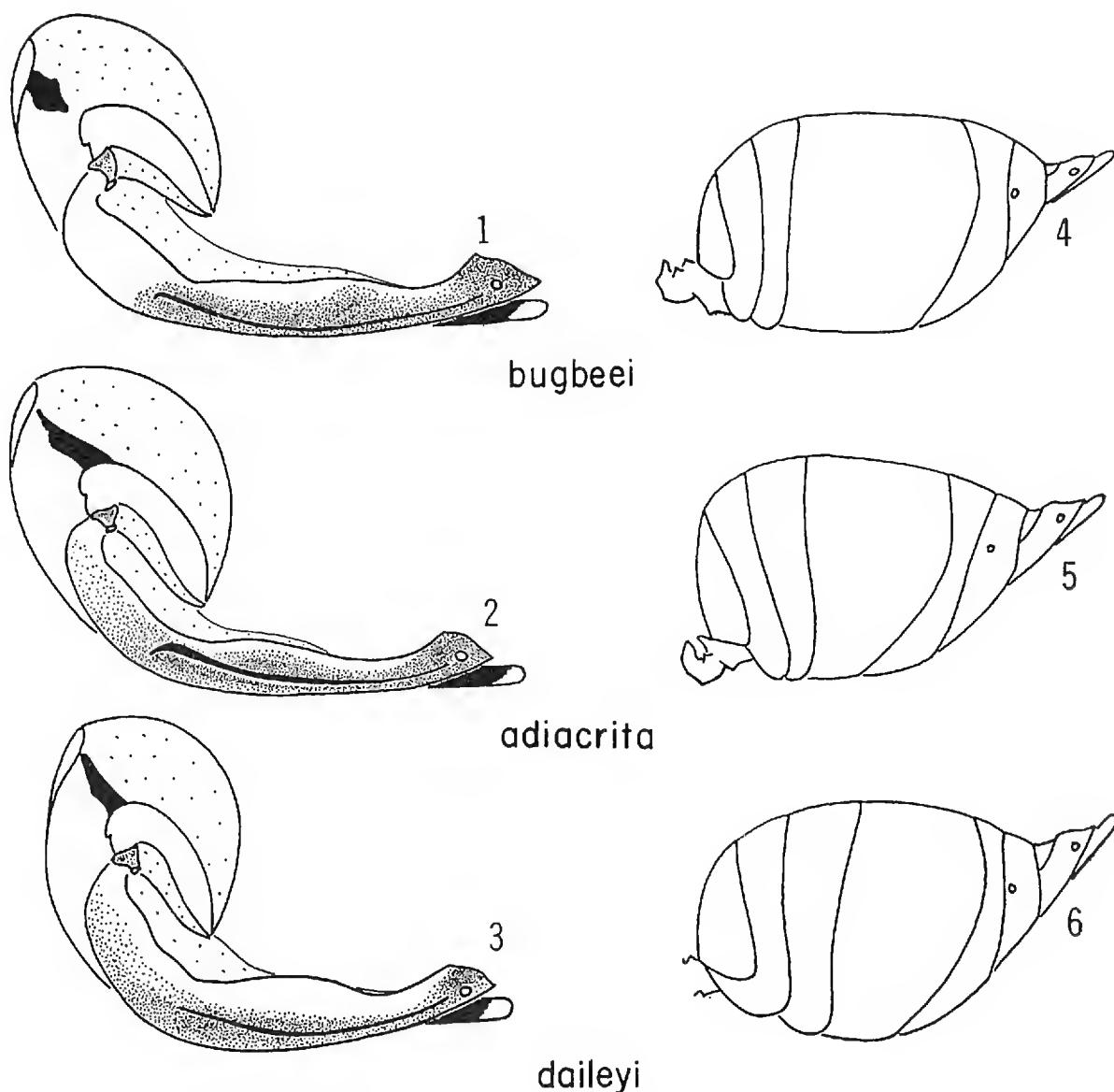
in Bugbee's revision of the genus *Eurytoma* (1967). Couplet 30 of his key (Complex IV. *Tylodermais*) is based upon the average length and range of the ninth abdominal tergum. *E. adiacrita* overlaps either choice of the couplet depending on whether the average length or range of the ninth tergum is used. If smaller specimens of *E. adiacrita* (i.e. those with shorter ninth terga) are keyed, they run to *E. spongiosa* Bugbee. *E. adiacrita* may be separated from *E. spongiosa* by its longer sixth tergum and more dorsally produced stylet arch in the female and its longer postmarginal vein in both sexes. Larger specimens of *E. adiacrita* key to couplet 42. Here, *E. adiacrita* may be distinguished from *E. spina* Bugbee by its dorsally produced stylet arch and its narrow dorsal valves; it differs from the remaining species by its complete median furrow.

Among Californian species of *Eurytoma* attacking cynipids on oak, *E. adiacrita* is most easily confused with *E. foligalla* because they are often reared from the same hosts. Females of *E. adiacrita* may be distinguished by the compressed abdomen, tergum VI almost twice the length of V, the lack of heavy reticulation dorsally on tergum VI, and the darker coloration of the scape and legs.

Males of *E. adiacrita* are not morphologically separable from those of *E. foligalla*. On the basis of color, *E. adiacrita* may generally be separated by its black trochanters. *E. foligalla* usually has yellow trochanters. This character, while useful, is not consistent in all cases. It is best, where possible, to make associative rearings of both sexes.

***Eurytoma bugbeei* Grissell, new species**

HOLOTYPE FEMALE.—Length 2.4 mm. Mostly black and yellow, some reddish brown. Yellow as follows: undersides of scape, pedicel and flagellum, mid and hindtrochanters, distal third of fore and midfemora, distal tip of hindfemur, all tibiae and tarsi. Reddish brown as follows: flagellum above, two small spots at base of antennal sockets, mandibles, wing veins. Pubescence silvery white. Flagellum filiform with F1–3 longer than wide, F4–5 about as wide as long, pedicel 0.80 times length of F1. Striae converging on clypeus from middle of face, malar space bare, lacking setigerous pits, a thin deep groove present ventrad of compound eye fading towards mandible (Fig. 10), post genal lamella absent. Depression on anterior face of forecoxa indistinct, shallow. Propodeum shallowly depressed, without a median furrow, median and lateral carinae absent, area covered with evenly spaced, fine punctures. Postmarginal vein 0.50 times length of marginal vein which is twice as wide as postmarginal (Fig. 9). Abdomen oval in lateral view (Fig. 4), ovipositor tilted at about a 35° angle in relation to horizontal axis of abdomen, lateral surface of tergum VI with heavy reticulations covering lower half almost completely, narrow band continuing to $\frac{3}{4}$ tergum height anteriorly, reticulation on terga IV and V similar to VI but correspondingly narrower, dorsal and dorsolateral areas of terga IV–VI polished, tergum VI



FIGS. 1-6. Female *Eurytoma*, lateral view. Figs. 1-3. Genitalia. Figs. 4-6. Abdomens.

in dorsal view 3.1 times as long as V, and in lateral view about $\frac{1}{2}$ length of abdomen, tergum IX 0.15 mm. Genitalia as in Figure 1.

ALLOTYPE MALE.—Length 1.9 mm. Color as in female except as follows: scape, pedicel, and flagellum entirely black, trochanters all black, fore and midfemora yellow apically, hindfemur entirely black, hind tibia mostly black. Antenna with four pedicellate flagellomeres which are longer than wide, F5 separated from the two-articled terminal unit by a distinct annulation, scape not swollen anteromedially (Fig. 11). Face, coxae, and propodeum as in female. Postmarginal vein 0.50 times length of marginal vein. Abdominal petiole cylindrical, narrowing slightly distally, 2.4 times as long as broad, 1.1 times length of hindcoxa.

HOLOTYPE FEMALE, 1.5 MILES NORTHEAST THORNTON, SAN JOAQUIN COUNTY, CALIFORNIA, emerged 10 May 1968 from *Disholcaspis eldoradensis* (Beutenmueller) on *Quercus lobata*, S. Rosenthal and E. E. Grissell collectors; allotype male, 2 ♀, 3 ♂, same data as holotype. Paratypes, 7 ♀, 5 ♂, all from California: Napa Co.: 1 ♀, 7 miles w. Monticello Dam, em. 1 February 1968 (E. E. Grissell) from *Disholcaspis corallina* (Bassett) on *Quercus douglasii*; 2 ♀, Monticello, 11 Sep-

tember 1958 (R. L. Doutt) from terminal bud gall on *Quercus durata* Jepson. Marin Co.: 1 ♀, 1 ♂, Carson Ridge, em. 23 January 1968 (E. E. Grissell) from *Disholcaspis plumbella* Kinsey on *Q. durata*. Sacramento Co.: 2 ♀, Hood, em. 26 December 1964 and 26 March 1965 (S. Rosenthal) ex *Andricus kingi* on *Q. lobata*. Yolo Co.: 2 ♂, 2 miles e. Monticello Dam, em. 29 January 1968 (E. E. Grissell) ex *Disholcaspis eldoradensis* on *Q. lobata*; 1 ♀, 2 ♂, 3 miles sw. Madison, em. 31 October 1968 (E. E. Grissell) ex *Andricus kingi* on *Q. lobata*.

Holotype, allotype, and paratypes are deposited in the Entomology Museum, University of California at Davis. Paratypes have also been placed in the Division of Biological Control (University of California, Albany), the U. S. National Museum, and the Bugbee Collection (Meadville, Pa.).

Variation.—Females of *E. bugbeeii* range in length from 1.8 to 2.9 mm ($\bar{x} = 2.4$; $N = 9$) and males from 1.3 to 2.2 mm ($\bar{x} = 1.9$; $N = 10$). In females the pedicel averages 0.83 times F1 (range: 0.70–1.0), the postmarginal vein averages 0.56 times the marginal (0.50–0.67), tergum VI averages 3.5 times V (3.0–4.3), and tergum IX averages 0.13 mm (0.09–0.16). In males the postmarginal vein averages 0.54 times the marginal (0.46–0.67); the abdominal petiole averages 2.8 times as long as wide (2.4–3.3) and 1.1 times the length of the hindcoxa (1.0–1.2).

E. bugbeeii does not appear to vary significantly in structural characters (e.g. striae on face, smooth malar space, finely punctate propodeum) but may vary slightly in color. In females the red subantennal spots are present in most cases, but are absent in all but one male (the allotype). About half the female paratypes show some brownish coloration of the tegulae correlated with a slight increase in yellowing on the fore and midfemora. All female paratypes have the mid and hind trochanters yellow. Male paratypes have both the tegulae and trochanters black.

Hosts.—All but three specimens of *E. bugbeeii* were reared from galls caused by members of the genus *Disholcaspis*. Several species of *Eurytoma* from California (*californica*, *foligalla*, *furva* Bugbee) have been recorded from the same species of *Disholcaspis* galls, and it is apparent that much biological work needs to be done in order to better understand the exact relationships of these *Eurytoma* to their host(s). The species of *Disholcaspis* galls from which *E. bugbeeii* was reared are thick-walled, monothalamous galls. It is within the single, central chamber that the large *Disholcaspis* larva develops. However, the pithy walls of the gall may also harbor several larvae of other, smaller species of Cynipidae. These are inquilines in the genus *Synergus*. Based pri-

marily on size, *E. bugbee* is probably parasitic on one or more species of *Synergus* rather than on the gall-former itself.

Three specimens of *E. bugbee* were reared from the monothalamous, thin-walled gall of *Andricus kingi*. This gall also harbors members of the genus *Synergus*, but the relationships between gall-former, inquiline, and parasite are not known.

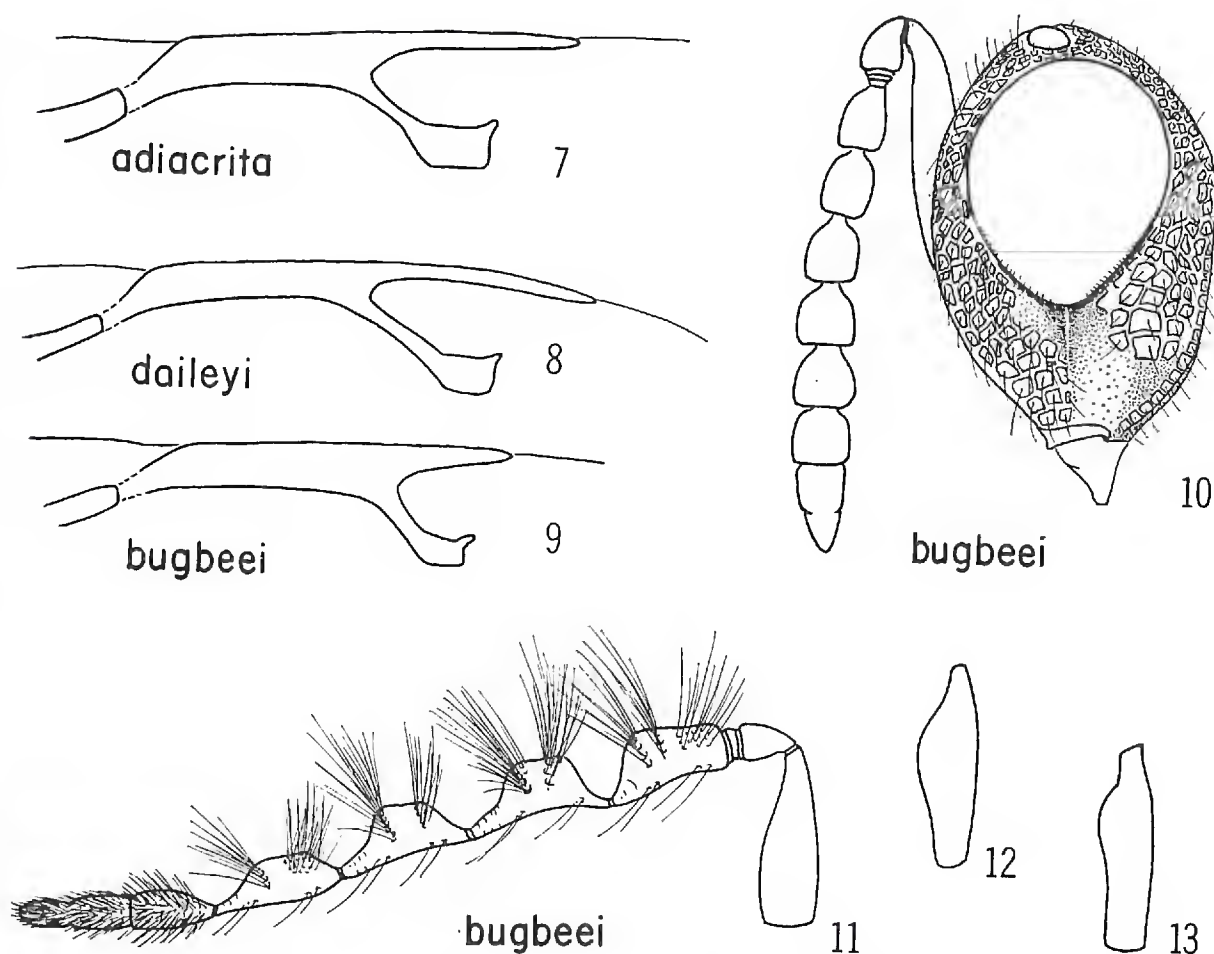
Systematics.—Females of *Eurytoma bugbee* key to *E. lacunae* Bugbee in Bugbee's 1967 revision of the genus *Eurytoma*. These two species are close morphologically as evidenced by the striae on the face, the shallow depression of the forecoxae, the distinctive propodeum, the lengths of the marginal and postmarginal veins, and especially the male antenna with 4 pedicellate flagellomeres. Females of *E. bugbee* may be separated by the absence of extensive sculpturing dorsally on tergum VI and the shorter tergum IX even though this species ranges generally slightly larger than *E. lacunae*. In addition, both sexes of *E. bugbee* may be separated from *E. lacunae* by a combination of the following characters: black coxae, legs mostly black, tegulae dark brown to black, and wing veins reddish brown with the marginal vein twice the width of the postmarginal (Fig. 9).

Eurytoma salicigalla Bugbee, described since Bugbee's 1967 revision of the genus, also runs to *E. lacunae* but may be separated from *E. bugbee* as follows: *E. bugbee* has the median area of the propodeum with minute, evenly spaced punctures (*E. salicigalla* with irregular carinae), tergum VI 3 to 4 times as long as tergum V (2 to 3 times in *E. salicigalla*), the lower half of tergum VI completely reticulate (lower $\frac{1}{3}$ or less in *E. salicigalla*, and then weakly so), and male with 4 pedicellate flagellomeres (5 in *E. salicigalla*).

This species is named in honor of Dr. Robert E. Bugbee whose many years of work constitute our major knowledge of Nearctic *Eurytoma*.

***Eurytoma daileyi* Grissell, new species**

HOLOTYPE FEMALE.—Length 2.5 mm. Mostly black and yellow, some reddish brown. Yellow as follows: scape, flagellum beneath, coxae and legs entirely, distal tip of ventral valves. Reddish brown as follows: mandibles, wing veins, lateral areas of abdominal terga III–VI partly. Pubescence silvery white. Flagellum moniliform with F1–3 longer than wide, F4–5 about as wide as long, pedicel 0.86 times length of F1. Face not striate, malar space with setigerous pits, post genal lamella present. Depression on anterior face of forecoxa distinct, moderately deep. Propodeum with wide but incomplete median furrow which narrows ventrally, lateral carinae distinct in upper $\frac{1}{3}$, median carina distinct in upper $\frac{1}{3}$, lateral surfaces wide and unevenly punctate. Postmarginal vein slightly curved, 0.87 times length of marginal vein (Fig. 8). Abdomen oval in lateral view (Fig. 6), ovipositor tilted at about 45° from horizontal axis of abdomen, lateral surface



FIGS. 7-13. *Eurytoma*. Figs. 7-9. Wing veins, dorsal view. Fig. 10. Head, lateral view. Fig. 11. Male antenna, lateral view. Fig. 12. Scape of *daileyi* male, lateral view. Fig. 13. Scape of *adiacrita* male, lateral view.

of tergum VI with faint reticulation covering lower $\frac{1}{4}$, thinning to lower $\frac{1}{2}$ anteriorly, terga IV and V laterally with a small area of reticulation antero-medially, dorsal surfaces of terga IV-VI highly polished, tergum VI in dorsal view 1.7 times as long as V and in lateral view about $\frac{2}{5}$ length of abdomen, tergum IX 0.13 mm. Genitalia as in Figure 3.

ALLOTYPE MALE.—Length 1.9 mm. Color as in female except as follows: scape yellow on basal $\frac{1}{3}$, flagellum entirely black, hindcoxa smoky, hindfemur and tibia with a black smudge medially, abdomen entirely black. Antenna with five pedicellate flagellomeres which are longer than wide and a terminal unit of two closely fused articles, scape distinctly swollen anteromedially (Fig. 12). Face and coxae as in female. Propodeum as in female except median carina inconspicuous. Postmarginal vein slightly curved, 1.0 times length of marginal. Abdominal petiole cylindrical, 2.3 times as long as broad, 0.97 times length of hindcoxa.

HOLOTYPE FEMALE, MORONGA RIDGE, CONTRA COSTA COUNTY, CALIFORNIA, emerged 10 March 1968 from galls of *Diastrophus kincaidii* Gillette on *Rubus parviflorus* Nuttall, D. C. Dailey collector, No. 1051; allotype male, 6 ♀, and 3 ♂ paratypes same data except emergence from February to March. Additional paratypes, 1 ♀, 3 ♂,

Baltic Mine (near Washington), Nevada County, California, em. December 1967, same host and collector as holotype.

Holotype, allotype, and paratypes of *E. daileyi* are deposited in the Entomology Museum, University of California at Davis. Paratypes have also been placed in the U. S. National Museum and the Bugbee Collection (Meadville, Pa.).

Variation.—Females of *daileyi* range in length from 1.9 to 2.5 mm ($\bar{x} = 2.3$; $N = 16$) and males from 1.5 to 2.5 mm ($\bar{x} = 2.1$; $N = 17$). In females the pedicel averages 0.89 times Fl (range: 0.73–0.90), the postmarginal vein averages 0.90 times the marginal (0.76–1.0), tergum VI averages 1.7 times V (1.6–1.9), and tergum IX averages 0.13 mm (0.09–0.15). In males the postmarginal vein averages 0.89 times the marginal (0.82–1.0); the abdominal petiole averages 2.3 times as long as wide (1.9–2.7) and 0.93 times the length of the hindcoxa (0.82–1.1).

All specimens show at least some yellow on the coxae and legs. Females vary only slightly in terms of color (i.e. hindcoxa occasionally with a slight black smudge). Males, however, vary noticeably in the amount of yellow present on coxae and legs. In some cases all coxae may have some black infuscation. In other specimens only the forecoxae are solid yellow while the mid and hindcoxae are entirely black. In males the legs vary from all yellow to yellow with black infuscation. Both sexes appear to vary somewhat in the structure of the propodeum. The lateral carinae are never complete and may be almost absent, indicated only by short ridges at the extreme top of the furrow. The central carina may be present but incomplete, or absent. Punctuation varies from fine and dense over the entire surface (when the lateral carinae are nearly absent) to uneven and limited to lateral areas and lower third of furrow.

Systematics.—Females of *Eurytoma daileyi* key to *E. celtigalla* Bugbee in Bugbee's 1967 revision. These two species appear quite similar in size, general coloration, relationship of wing veins, the broad dorsal valves of the genitalia, and the short abdominal petiole in the males. *E. daileyi* females, however, may be separated by the following characters: flagellomeres 4 and 5 as wide as long, pedicel three-fourths or more length of Fl, tegulae black, median furrow incomplete, tergum VI in dorsal view usually distinctly less than twice the length of tergum V, and tergum IX ranging slightly shorter in length. Males of *E. daileyi* can best be separated from *E. celtigalla* by the incomplete median furrow, the black tegulae, and the long, slightly curved postmarginal vein.

This species is named in honor of Charles Dailey who has contributed greatly to our knowledge of the parasitoids of gall-forming Cynipidae.

EURYTOMA CALIFORNICA Ashmead

Eurytoma californica Ashmead, 1887: 195.

Eurytoma querci Fullaway, 1912: 278. **New Synonymy.**

The lectotype female of *E. californica* is in the United States National Museum. The holotype female of *E. querci* is housed in the Los Angeles County Museum, having been moved there from Stanford University some years ago. I have seen both types as well as several hundred specimens of *E. californica*; the holotype of *E. querci* clearly falls within the variation of *E. californica*. Fullaway associated a male specimen from a different lot number and host with the female of *E. querci*. This specimen is quite similar to males of *E. californica* but does not have the flagellomeres pedicellate and lacks the whorls of long setae on each segment, a condition not known in other North American species of *Eurytoma*. It is possible that the single male represents an aberrant specimen of *E. californica* or an undescribed species which has been incorrectly associated with this species. The possibility also arises that it is the male of an unrecognized genus.

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